for 10, 100, 1000, and 10,000. The number 25,647, for example, may be written either from the top downwards or from left to right, as follows: 2 (10,000's), 5 (1000's), 6 (100's), 4 (10's), and 7; or else the symbol 2 followed by the symbol 10,000, the symbol 5 followed by the symbol 1000, the symbol 6 followed by the symbol 100, and so on. Apart from the 'rod' system, the Chinese have 3 general systems of N.—the anct national, the modern national (with the 'place-value,' and the circle used as 'zero'), and the commercial.

The Maya and Aztec numerical systems were vigesimal, and they wrote 20 as we write 10, using their characters for 20 and zero. In the Maya system 1 to 4 were represented by dots; 5, 10, 15, by sticks, lines, or bars, and 20 perhaps by the moon. The symbols for the multiples of 20 (400, 8000, 160,000, etc.) are still uncertain; it may be, however, that they had the 'place-value' notation. In the Aztec system 1 to 19 were represented by dots or circles, 20 by a religious banner, 400 (20 × 20) by a pine tree, 8000 (20 × 20 × 20) by an incense-pouch. The most important feature of the Maya system was their zero, the importance of which was recognised by the Maya many cents. before any other people in the world; this symbol was similar to a shell, having numerous variants. The highest number found in a Maya inscription is 1,841,639,800 days, corresponding to over 5,100,000 years.

The Alphabetical Systems. The Jews, like the Syrians, the Arabs, and some other peoples, used the letters of their alphabet for numerical symbols, taking the first letter for 1, the second for 2, the tenth for 10, the eleventh for 20, and so forth, the last one (the 22nd) denoting 400. In the Talmud the numbers above 400 are formed by composition (500 = 400 + 100; 900 = 400 + 400 + 100); in later times the final forms of the letters *k*, *m*, *n*, *p*, *ṣ* were

א	ב	ג	ד	ה	ו	ז	ח	ט	י
1	2	3	4	5	6	7	8	9	10
כ	ל	מ	נ	ס	ע	פ	צ		ק
20	30	40	50	60	70	80	90		100
ר	ש	ת	ך	ם	ן	ף	ץ		
200	300	400	500	600	700	800	900		

FIG. 2

HEBREW NUMERICAL SYSTEM

respectively used for 500, 600, 700, 800, 900. The later Hebrew numerical system is shown in Fig. 2. The thousands were represented by the same letters as the units, sometimes followed by a kind of apostrophe.

The Greeks used the letters of their alphabet for numerical notation in the same way as did the Jews. Since they had 24 letters in their classical alphabet, and for a more satisfactory system of N. they needed 27 letters, they retained the anct N.-Semitic-Gk letters *digamma* (as 6), *koppa* (as 90), and *sampi* as 900. Originally the capital forms were used; at a later stage the minusculae were employed. To distinguish the N. from letters a bar was commonly written over each number (Ā), but sometimes the letter was written as if lying on its side (ᗕ). The thousands

α	β	γ	δ	ε	ϝ	ζ	η	θ
1	2	3	4	5	6	7	8	9
ι	κ	λ	μ	ν	ξ	ο	π	ϟ
10	20	30	40	50	60	70	80	90
ρ	σ	τ	υ	φ	χ	ψ	ω	ϡ
100	200	300	400	500	600	700	800	900
,α	,β	,γ	,δ	,ε	,ϝ	,ζ		
1000	2000	3000	4000	5000	6000	7000		
,η	,θ							
8000	9000							

FIG. 3

GREEK NUMERICAL SYSTEM

were often indicated by placing a bar to the left or, in modern Gk type, by ,α, ,β, ,γ, ,δ, ,ε, ,ϝ, etc. This Gk numerical system is shown in Fig. 3. The myriads (= 10,000's) were represented by M or $\overset{\beta}{M}$ (10,000), $\overset{\gamma}{M}$ (20,000), $\overset{\delta}{M}$ (30,000), and so on, or by a special symbol (Ω) superscribed on units.

The Greeks had also the numerical system known as Herodianic (so named after the grammarian Herodianus, late 2nd cent. AD, who fully described it) or Attic (it is the only system found on anct Attic inscriptions) or acrophonic (the initial of the name of the numbe being used as its symbol), while simple vertical strokes were used for the numbers 1 to 4. Thus Γ (an old form for Π, initial of ΠENTE, *pénte*), 5; Δ (ΔEKA, *déka*), 10; H (HEKATON, *hekatón*), 100; X (XILIOI, *khílioi*), 1000; M (MYPIOI, *mýrioi*), 10,000. These N. were frequently combined in ligatures. Tens of thousands were sometimes indicated by dots. Special symbols were sometimes used for fractions, sometimes an accent or a line above the numeral indicated the fraction: as, for instance; υ or $\upsilon' = \frac{1}{2}$, $\gamma' = \frac{1}{3}$, $\upsilon\gamma' = \frac{1}{2}+\frac{1}{3}$ or $\frac{5}{6}$, $\gamma\beta' = \frac{2}{3}$, $\delta' = \frac{1}{4}$.

The Etrusco-Roman Numerals. The origin of the Etruscan and Rom. N. is still obscure (apart from the N. 1 to 4, which were represented by one to four vertical strokes (I, II, III, IIII)). Etruscan had special symbols for 5. 10, 50, 100, and 500. According to some scholars (e.g.

Mattheus Hostus, 16th cent., and De Feis, 19th cent.), they were based on number 5; thus Λ for 5 would be the inverted form of V, which was derived from the open hand, the fingers with the exception of the thumb being held together; X for 10 would be a double V; 50 would be the 5 with a vertical stroke, and doubled would represent 100; and a horizontal stroke on the base of 50, 500 (*see* Fig. 4). According to another theory these symbols were based on the decimal system, X for 10 being derived from two oblique lines crossed, 100 being the same symbol with the addition of a vertical line, and 5 and 50 being the same symbols halved (Fig. 4). Concerning the origin of the

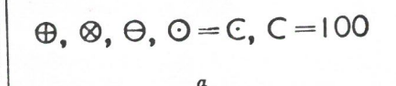
I	II	III	IIII	Λ	X	Ⱶ	Ж	Ⱡ
1	2	3	4	5	10	50	100	500

FIG. 4

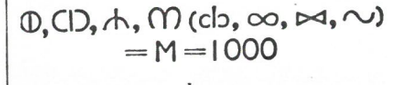
ETRUSCAN NUMERALS

Rom. symbols C (100), M (1000), L (50), and D (500), the most probable theory is that they derive from the Gk letters *thēta*, *phi*, and *khi*, which the Romans did not use as letters but retained as numbers. As to the use of *thēta* for 100 we have also early forms (*see* Fig. 5*a*), and we may assume that written rapidly with a stylus or a reed pen the circular symbol was left incomplete, and under the influence of the initial of C(ENTUM) (100) it became C. *Phi* (Fig. 5*b*) became the symbol for 1000 and under influence of M(ILLE) (1000) became M. An early form of the Gk letter *khi* (Fig. 5*c*) became L for 50. D is generally thought to be merely half of the letter *phi*; it was occasionally written Cl (*see* Fig. 5*b*) and appears very commonly as IↃ . The Etruscans and the Romans also employed other numerical symbols, but the aforementioned were the most commonly used. The vitality of the Rom. N. is astonishing; they were used throughout the Middle Ages, holding their own against the Indo-Arabic N., even being preferred for the calculation of money accounts, and, of course, they are still in use at the present day, though apparently confined to such purposes as the numbering of chapters in a book, and the chaptering of private statutes to differentiate them from public acts.

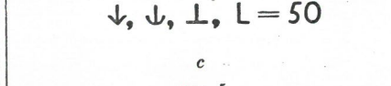
The present system of Rom. N., in which, for example, 1958 is written MCMLVIII, is a relatively recent development. In classical and early medieval times there was no unified method, especially in the case of large N. For 1000 there were various symbols: ϕ, $\overline{\text{X}}$, ∝, or (I) or $\overline{\text{I}}$ (*see also* above, concerning the origin of M = 1000); multiple thousands could be indicated either by a bar over a number, such as $\overline{\text{I}}$ = 1000; $\overline{\text{X}}$ = 10,000; $\overline{\text{C}}$ = 100,000 (unless the bar was employed to distinguish the numeral from a noun), or by a semicircle: (ϕ) = 10,000, ((ϕ)) = 100,000, or else (I) = 1000, ((I)) = 10,000, (((I))) = 100,000. The last symbol, repeated 23 times (= 2,300,000), appears on the *columna rostrata* inscription, commemorating the Rom. victory off Mylae (Milazzo) in the First Punic war (260 BC). In some inscriptions we also find IXI (or $\overline{\text{IX}}$I) for ten hundred thousand and IMI for thousand hundred thousand. The forms CIↃ (= 1000) and IↃ (= 500) appear as late as the 16th cent. The subtractive principle (IV instead of IIII, for 4; IX instead of VIIII, for 9;



a



b



c

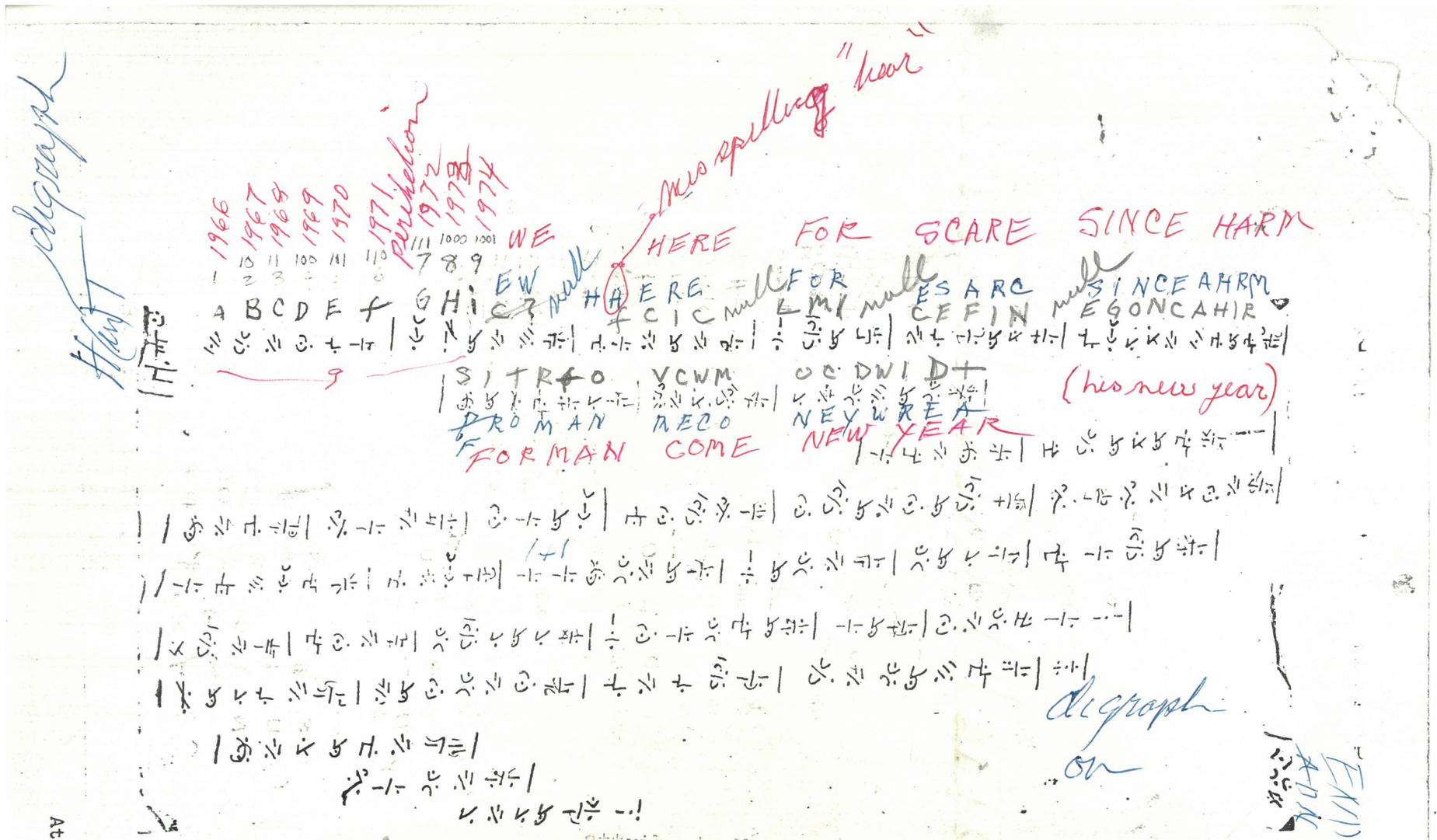
FIG. 5

ORIGIN OF THE HIGHER ROMAN NUMERALS

a, 100 from the Greek *thēta*; *b*, 1000 from the Greek *phi*; *c*, 50 from an early form of the Greek *khi*.

XC instead of LXXXX, for 90; and XCIX instead of LXXXXVIIII, for 99) was rather rare even in medieval times; indeed, we generally find CCCC for 400, IIII for 4, etc. But already in the late 16th cent. (ed. of Capella, Leyden, 1599) we find CIↃ. IↃ (= 1000. 500. 99) for 1599. It is worth while mentioning that in France down to the 18th cent. we find Rom. numerals used in combination with the vigesimal system (*see* above): iiij^{xx} (= 4 × 20 = quatre-vingts = 80).

The 'Arabic' Numerals. The expression 'Arabic N.' used for our common system of numerical notation is a misnomer. Moreover the origin of this system is not quite certain. It is, however, generally believed that our common numerical symbols originated in India, that they were carried to Bagdad in the 8th cent. AD, and thence found their way to Europe, where they were known, in Spain and in Italy, at least in the 10th cent. The Arabs themselves attributed the origin of the 'Arabic' N. to the Hindu and called them *hindasi*. The great Arabian mathematician ('Abū 'Abdallāh Mohammed ibn Mūsa) al-Ḫuwārizmī, of the 7th to 8th cent., wrote a treatise on the *hisāb hindī*, 'the Hindu calculation.' Carra de Vaux (*Scientia*, 1917, p. 273), however, suggested that the Arabic word *hind*,



using playfair square of 5th order reads approx.
"WE HERE FOR SCARE SINCE HARM FOR MAN COME NEW YEAR."
(His new year)
"HELP BRING MARS" (not people from Mars)
"HEAR ME AT AREA TONIGHT TO RETORT QUESTIONS. WARNING
HAVE 2 (alpha plus alpha) PAPER READY NEAR ROOM. COME
MEET (AT) ONE OR LATER. WE ARE TALKING(FROM) ON R
(OUR) SEA. LETTERS ARE TO BE DRAWN ON PARCHMENT."

(signed) Qadencnral

Attachment 2

note 52 years (see 52 year period Vehbobalay-Winic)

12
104
52
624

780 days synodac period of mars.
(numbers of days between superior conjunctions) 3 times the 260 Divine
Aztec Calender 3 × 260 = 780

780 days synodac period Mars
2 | 584 synodac Venus
292 days between
Superior Conj of Venus
to Inferior Conj of Venus

780
292
1560
7020
1560
227760

624 years
365 | 227760 days
2190
876
730
1460
1460
0

13 days dropped every 52 years. due to 1/4 day in 365 1/4
One day comes up every 624 years
where ☥ ☾ ☌ Sun

Attachment 2

Greek
Sigma 200
Tau 300
Omicron 70
Nu 50
620

GREEK 200 300 70 50

o = 1
c = 5
) = 10 ?

!!!

card + old number

17

J K L M N O P Q
1 2 etc
R S T U V W X Y Z
17th

17 years
missing letters from page 2
opposition mars from Leo to Leo see mars chart included

March 1965
Feb. 17 1948

Note decipherment of this sheet.

17 yrs

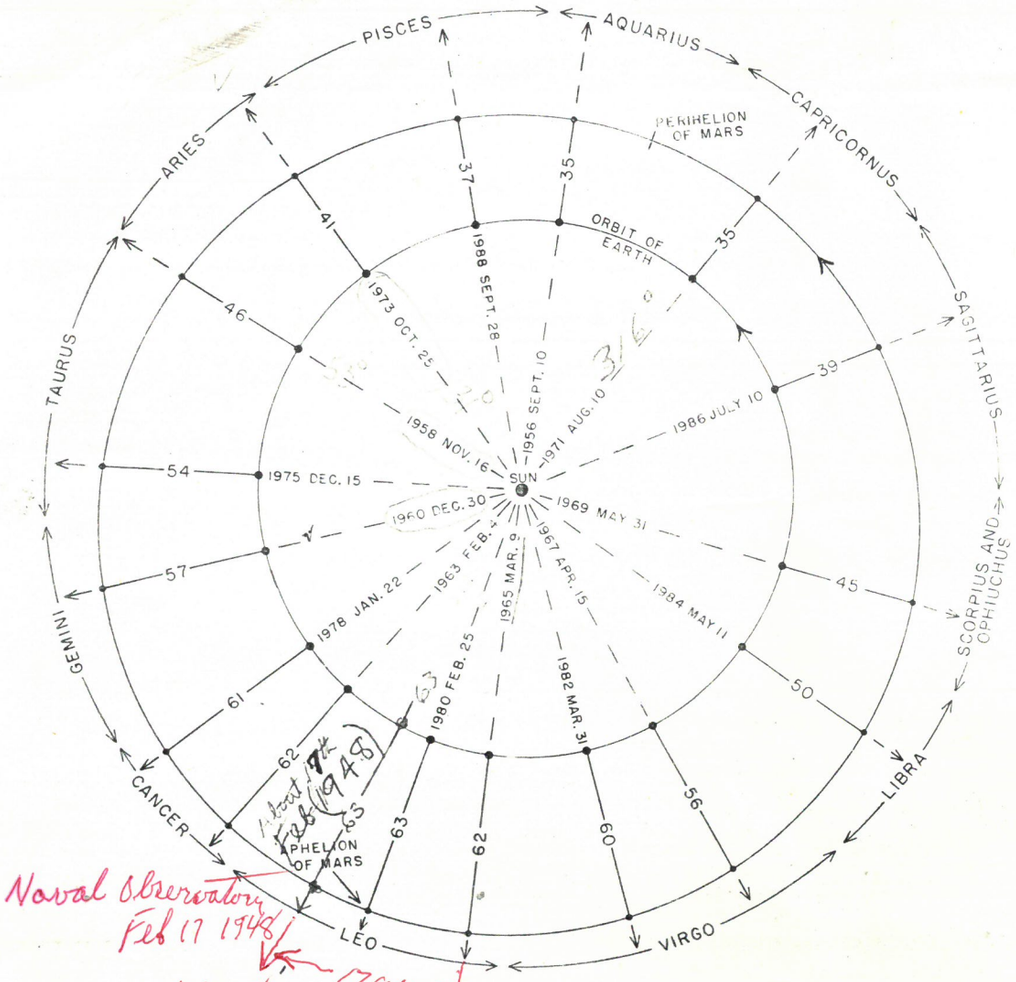


Fig. 4. Oppositions of Mars from 1956 to 1988.

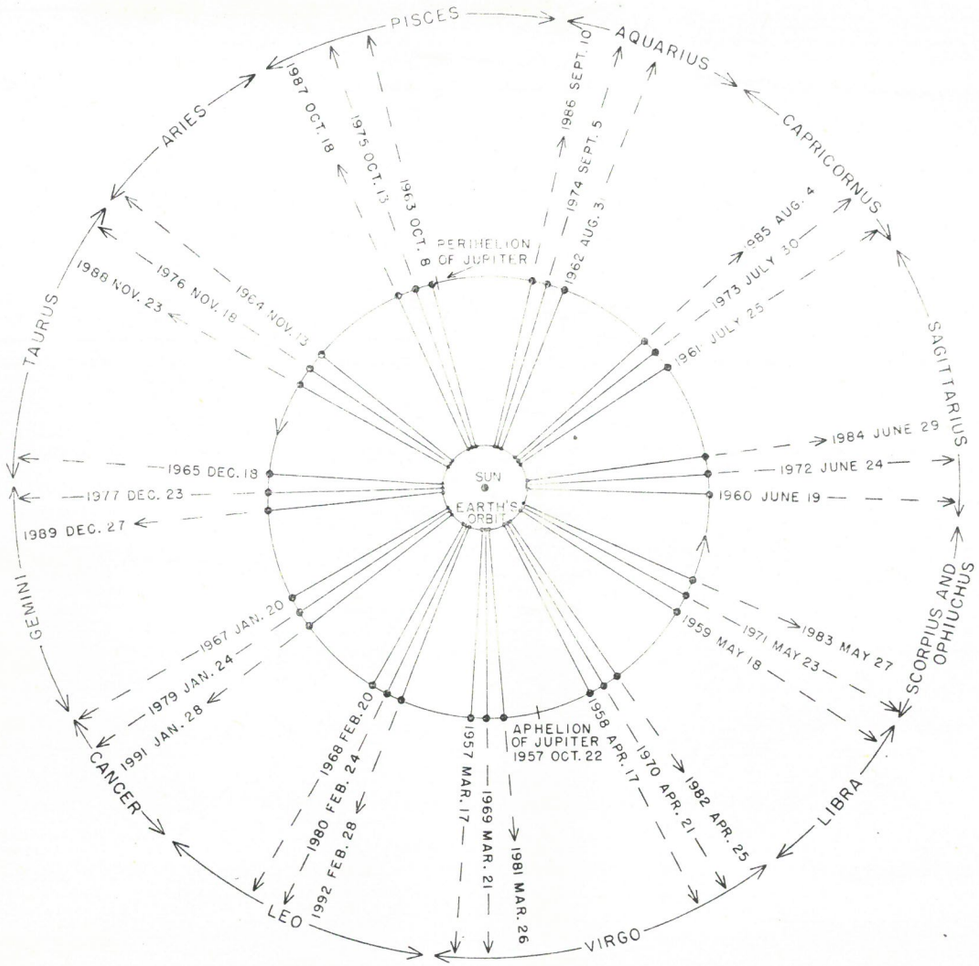


Fig. 5. Oppositions of Jupiter from 1957 to 1992.

before the sun. After rising slightly earlier each day for about a year, it will rise at sunset on 1958 November 16, when it is in opposition.

Fig. 4 shows the orbits of the earth and Mars, the oppositions from 1956 through 1988, and the constellation in which Mars appears at each opposition. Also the distance in millions of miles from the earth to Mars is marked at each opposition.

The dates from 1956 through 1971 are marked close to the sun, and the dates from 1973 through 1988 are marked just inside the earth's orbit. The most favorable oppositions occur near the perihelion of Mars, which is its closest point to the sun. The three nearest approaches of Mars to the earth shown here are for 1956, 1971, and 1988. The interval between the first two dates is 15 years and that between the last two is 17 years.

The names lying on a circle on the outside of Fig. 4 indicate the directions of the constellations in which Mars appears at the different oppositions. Although there are only twelve constellations in the zodiac, a planet can sometimes be within the area of a neighboring constellation when it is a few degrees from the ecliptic (the plane of the earth's orbit). In fact, a part of the ecliptic about 18 long lies within the boundaries of Ophiuchus, which is not one of the constellations of the zodiac. The part of the ecliptic within the

followed by the great age of
the Heroes

who perished in such wars as those
at Thebes and Troy

but others went west to the end of
the world

and live there in bliss even
today

seized them, and they had to forsake
the shining sunlight.

Now when the earth had gathered over this generation
also, Zeus, son of Kronos, created yet another
fourth generation on the fertile earth,
and these were better and nobler,
the wonderful generation of hero-men, who are also
called half-gods, the generation before our own
on this vast earth.
But of these too, evil war and the terrible carnage
took some; some by seven-gated Thebes
in the land of Kadmos
as they fought together over the flocks of Oidipous;
others
war had taken in ships over the great gulf
of the sea,
where they also fought for the sake
of lovely-haired Helen.
There, for these, the end of death was misted
about them.
But on others Zeus, son of Kronos, settled a living
and a country
of their own, apart from human kind,
at the end of the world.
And there they have their dwelling place,
and hearts free of sorrow
in the islands of the blessed
by the deep-swirling stream of the ocean,
prospering heroes, on whom in every year
three times over
the fruitful grainland bestows its sweet yield.
These live

Then Zeus made the Fifth
Age, of Iron

mine

I wish it were not

Zeus will destroy this age too

When it has gone bad and lost
all sense of right and wrong

far from the immortals, and Kronos
is king among them.
For Zeus, father of gods and mortals,
set him free from his bondage,
although the position and the glory still belong
to the young gods.

After this, Zeus of the wide brows
established yet one more
generation of men, the fifth, to be
on the fertile earth.

And I wish that I were not any part
of the fifth generation
of men, but had died before it came,
or been born afterward.
For here now is the age of iron. Never by daytime
will there be an end to hard work and pain,
nor in the night
to weariness, when the gods will send anxieties
to trouble us.
Yet here also there shall be some good things
mixed with the evils.
But Zeus will destroy this generation of mortals
also,
in the time when children, as they are born,
grow gray on the temples,
when the father no longer agrees with the children,
nor children with their father,
when guest is no longer at one with host,
nor companion to companion,
when your brother is no longer your friend,
as he was in the old days.

Little man
70+3 5012

(*nemontemi*), were the unlucky days and neither named nor counted, just as in New York City many buildings do not have a thirteenth floor.

The least common multiple of 260 (20 by 13) and 365 (whose primes are 5 and 73), as Franz Boas graphically explained,[5] is 18,980 days. This was the fifty-two-year cycle; after this period the same divinatory combination repeated itself. In another form the Aztec astronomer-mathematicians, or those from whom they obtained this most complicated, ingenious calendar, determined that seventy-three years of the divine calendar (20 by 13 by 73) resulted in the same 18,980 days, making again the magical fifty-two-year cycle.

Why this fifty-two-year cycle? Why was fleeting time so great an obsession with the Aztecs? Why did it become a national fetish so that they really believed that at the end of a fifty-two-year cycle the very future of the world was in balance and might be destroyed? Did the very cleverness of the mathematicians seduce them? Did the fact that these two calendars just happened to coalesce in the various calculations to make the fifty-two-year cycle seem so magical that they conceived their inventions to be really a basic fact of nature? No one really knows.

The Aztecs' relation with time was fundamentally emotional. Their priest-astronomers had put great intellectual effort into the elaboration of the calendar. As a calendar, it was more advanced than in either Egypt or Greece. Egypt and Mesopotamia had lunar calendars, i.e., the beginning of every new month was determined by the waxing or waning of the moon. They made up for the discrepancy between lunar and solar by having "hollow" and "full" months, and this crude form of calendar existed down to Roman times. All peoples strongly agricultural in character gave great importance to the solar year, but the cities in the Fertile Crescent had different calculations, which produced chaos in comparative time reckoning. The Egyptians (as did the Mayas and Aztecs) had two systems: a religious lunar calendar and a civil 365-day calendar; and a twenty-five-year cycle.

The Greeks in the time of Hipparchus (150 B.C.), taking over the whole of Babylonian science, began to use "the methods of computing sexagesimally and the place-value notation, including a symbol for zero,"[64] but the use of the zero symbol never came into general practice until the Hindus perfected it in the eighth century A.D. Yet the "American" cultures were far, far in advance of all this; the Mayas

invented zero and could calculate their day count as far into the past as 23,040,000,000 days.[64]

Why all this? Why this extraordinary preoccupation with time? Did they find the endless continuity of time so appalling even though they marked it into spatialized periods with rituals and festivals? No one knows. The dominant note was the fifty-two-year cycle; the whole of the tribe's intellectual forces was put to work long before its advent to allay the wrath of the gods.

The priests had to calculate ritual by most involved methods; they had to know the precise interconnection between each particular god and "time" as given on the calendar. Sacrifice had to be correctly calculated so that it would benefit the particular god to whom they were appealing. All the developed intellect of the Aztec was turned toward this one thing: how to propitiate the right god at the right time. So sacrifice was not mere butchery, it was a parade of elaborately conceived ritual with only one object in view: to preserve human existence.

For the Aztec was threatened not only at the end of each fifty-two-year cycle; when the priests announced the end of each year there came the dreaded *nemontemi*, the "five empty days." Fires were extinguished, fasting was general, sexual intercourse ceased; artists left off their work, business lay idle. The same thing occurs in the Austrian Tyrol when the *Föhn*—the warm south wind—blows: important business grinds to a halt. No transactions on these days have legality. On the dawn of the fifth day, when the priest-astronomers, consulting their calendar books, observed the Pleiades rising in the heavens and knew the world would not end, they reached out and found a sacrificial victim, slashed open his chest, pulled out his heart, and in the freshly weeping wound kindled a new fire; from it all the fires in the temples were rekindled; and from it people all over Mexico-Tenochititlán gathered the new fire for the new year.

All was right once more with the Aztec world.